IN-HOUSE COMPOSTING OF TURKEY MORTALITIES AS A RAPID RESPONSE TO CATASTROPHIC LOSSES

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An avian influenza (AI) outbreak in the central Shenandoah Valley of Virginia in the spring and summer of 2002 affected 197 poultry farms and had an estimated cost of $130 million to the poultry farmers and state economy. The total federal cost of avian influenza eradication in Virginia, including indemnity, was $81 million (Akey 2003; Swayne and Akey, 2004). Seventy-nine percent of the farms depopulated were turkey breeder and growout flocks. Five different methods were used to dispose of avian influenza infected poultry: on-farm burial, landfilling, incineration, slaughter, and composting (Ag-Bag and in-house). More than 3.1 of the 4.7 million birds infected or 13,000 tons were disposed of in landfills (DEQ 2002). Landfilling has been the preferred option for disposal because the infected flock can be removed from the poultry farm relatively quickly, which enables the farmer to begin cleaning and disinfecting the poultry houses. Drawbacks of landfilling include expense, transportation logistics, biosecurity risks, public perception issues, and environmental considerations. In 2002, turkey disposal costs exceeded $7.25 million with an average cost per farm of $30,175. The cost per ton with depopulation and disposal approached $145 not including the costs of additional litter handling at the farm.

Avian influenza depopulated poultry houses remained under quarantine on an average of 75 days each and for as long as 177 days (DEQ 2002). Composting was implemented as a disposal technology for two flocks during the outbreak with limited supervision and success. In-house composting has not been considered a viable option by the industry because of the potential loss of production space and the perception that composting would not work on larger birds. Successful in-house composting of 5-pound broilers on the Delmarva Peninsula in 2004 proved the effectiveness of composting as a method of disposal and containment for an AI outbreak (Malone, 2004a; Malone et al., 2004b). Avian influenza was confined to 3 farms despite the high

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density of poultry farms in the area. In-house composting appears to be the most acceptable method of disposal because it limits the risks of groundwater and air pollution, high fuel costs, potential for farm-to-farm disease transmission, transportation costs, and tipping fees (Tablante et al., 2002).

The project objectives were:

- To test in-house composting as a method of disposal and disease containment for large birds (i.e., 17 to 40 pounds);
- To determine how quickly the in-house process could be completed;
- To test the effectiveness of carbon sources and rates;
- To compare the effectiveness of composting whole carcasses, shredded and tilled carcasses, and crushed carcasses;
- To demonstrate the composting process for farmers, industry and agency personnel.

The demonstration was initiated on December 2, 2004. Eight windrows (12' wide by 6' high), each representing a treatment, were formed. Each windrow contained 2500 to 3000 pounds of turkey carcasses weighing from 17 to 40 pounds each. An additional experiment was conducted to compare the effectiveness of crushing the carcasses versus whole birds and to determine the minimum amount of carbon material needed to prevent leakage and encourage composting at the highest possible density per square foot. The temperatures of all the windrows (i.e., at 10 and 30 inch depths) reached between 135 and 145 degrees F and maintained temperatures adequate for pathogen kill. The windrow with woodchips as the carbon source achieved the highest temperatures (Figure 1).

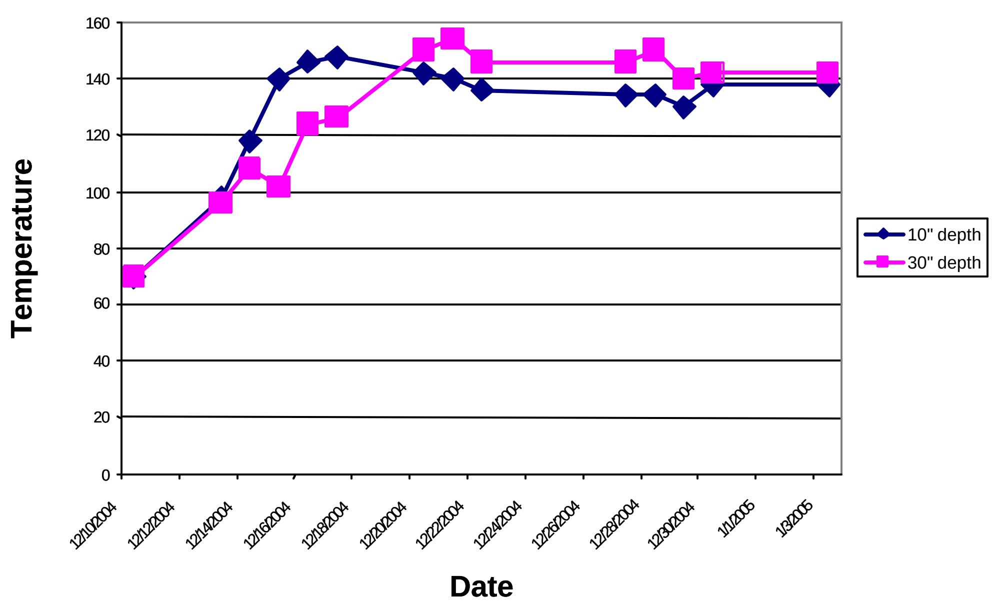

Figure 1. Daily temperatures of woodchips and whole carcass treatment.

Carbon materials compared for their effectiveness in composting turkey carcasses included:

- Hardwood Sawdust;

- Aged, weathered woodchips with relatively high moisture;
- Built-up Litter;
- Starter litter or wood shavings from brooder house;
- Blend of starter litter and built-up litter.

The turkey carcass treatments included:

- Whole carcasses mixed and piled;
- Shredded and tilled carcasses, mixed and piled;
- Crushed carcasses mixed and piled.

The results of the research and demonstration are summarized as follows:

- After two weeks, few carcasses remained in any of the windrow treatments.
- All four carbon materials (i.e., hardwood sawdust, woodchips, built-up litter, and starter litter) were effective in composting the turkey mortalities.
- Temperatures of all the windrows (at 10 and 30 inch depths) reached 140 degrees and maintained temperatures adequate for pathogen kill.
- Woodchips reached and maintained the highest temperatures due to good porosity, varying particle size, and relatively ideal moisture content.
- The starter litter required that some water be added during the mixing process, but only enough to make the litter and mixture glisten.
- Shredding and tilling the carcasses increased the effectiveness of composting approximately 2 to 3 days by increasing the surface area to volume ratio and exposing the bones and marrow to further decomposition and releasing more moisture into the compost mix.
- Whole carcasses composted as well without tilling.
- Tilling the litter floor after depopulation to break up excessive caked or crusted litter helped to increase the composting process and prevent any seepage.
- Maintaining the base and cap on the windrow is essential to composting and preventing any carcasses from being exposed to the air which can prevent decomposition.
- An alternative to tilling and shredding the birds would be to crush the birds by running them over with a skid loader or tractor.

To determine the minimum amount of carbon material needed, an additional experiment was setup to simulate the worst case scenario (i.e., where a farmer had very little litter or carbon material available following a clean-out and was attempting to compost heavy toms (~ 35 to 40 pounds)). The treatments compared were crushed carcasses versus whole carcasses. These were mixed with a blend of starter and built-up litter to achieve a density 12.5 pounds of carcass per square foot (Table 1) above a 5 inch base layer and below a 5 inch cap.

Table 1. Average characteristics of different turkey types and population densities.*

Bird Type	Age (weeks)	Weight (lbs.)	% Mortality	Population (after mortality)	Size of House (ft^2)	# of meat/ ft^2
Brooder hens	5	3.5	3	11,058	10,000	3.87
Brooder toms	5	4.0	4	8,640	10,000	3.46

Growout hens	14	17.5	2	10,837	20,000	9.48
Heavy hens	16	22	2	10,837	20,000	11.92
Light toms	15	24	8	7,949	20,000	9.54
Heavy toms	20	40	8	6,250	20,000	12.50

* The production goals and requirements for individual farms may vary from these averages.

The results from the experiment to determine the minimum carbon material needed for composting heavy toms are summarized as follows:

- Temperatures of 140+ degrees were achieved within 5 days for the crushed treatment and 16 days for the whole carcass treatment (Figure 2). Therefore, the poultry house could potentially become available 11 days sooner if the carcasses are initially crushed.
- With a 5 inch base layer and 5 inch cap (10" total), no seepage occurred at a density of 12.5 pounds per square foot and composting was promoted.
- Without crushing the carcasses, the whole birds tended to roll off the pile, require more labor, and take longer to begin composting.
- In the whole carcasses treatment, at least 0.8" of carbon material per pound of carcass was needed as a base and cap to adequately cover the carcass. More material, approximately 1" of carbon material per pound of carcass, was needed to promote composting.
- In the worst case scenario, where there is very little base litter (i.e., < 5") and heavy toms in the poultry house, two tractor trailer loads of additional carbon material may be needed per house to promote composting. (In 2002, seven tractor trailer trucks were needed per house to haul carcasses off the farm to the landfill.)

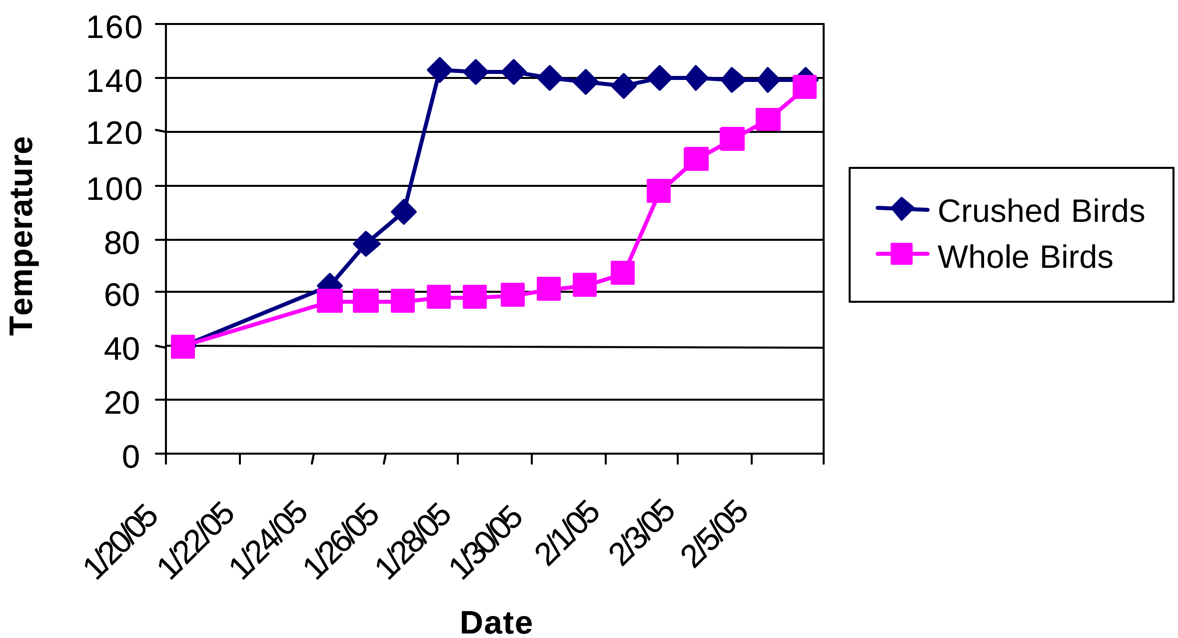

Figure 2. Temperatures of experiment to determine the minimum carbon material needed for composting at a density of 12.5 pounds of carcass per square foot.

A typical turkey farm affected with avian influenza in 2002 was as follows:

- 45,600 turkeys
  - 22,800 – 14 week old hens, Avg. body Wt. 16 lbs.
  - 22,800 – 4 week old hens, Avg. body Wt. 3 lbs.
- 352,000 pounds + 66,000 pounds = 418,000 pounds or 209 tons
- 14 Semi truck loads.

Cost estimates for in-house composting after euthanasia and depopulation:

- 2 skid loaders ~ $140 per house;
- 2 skid loader operators ~ $180 per house;
- 1 person knowledgeable of composting ~ $150 per house;
- 2 laborers ~ $120 per house for cleaning up litter and disinfecting skid loaders;
- 5 to 6 hours of operation per house including crushing the carcasses.
- 1 hour to clean and disinfect the skid loaders.

Cost estimates if no additional carbon is needed to compost the turkey carcasses:

- ~ $590 per house/ 104.5 tons of carcass per house = $5.65 per ton (if no additional carbon material is needed).
- ~ $700 for one 200' roll of reusable compost fleece per house if a litter storage shed is not available.

Cost estimates if additional carbon is needed to compost the turkey carcasses:

- ~ $1000 per house for hardwood sawdust.
- ~ $590 per house for labor and equipment.
- 104.5 tons of carcasses per house.
- $15.22 per ton (if additional carbon material is needed).
- ~ $700 for one 200' roll of reusable compost fleece per house.

Additional considerations for utilizing in-house composting as a disposal and disease containment method are summarized as follows:

- Farmers and industry have expressed concern about the quality of the finished product and the presence of bones. In the research with heavy toms, only the upper part of the leg bones was visible. Other bones broke down during the compost process.
- Application of the final compost to tillable row crops like corn, small grains, and soybeans would be the preferred method of utilization.
- Applications to pasture or hay land would require a simple method of screening the bones such as through a box spreader.
- In 2002, moving the untreated litter from AI infected farms was a problem and stigma. An incentive payment of $10.00 /ton of litter was needed and implemented to facilitate movement of 5000 tons of litter off farms.
- In-house composting could resolve some of these issues because composting reduces the volume of litter 40 to 60%, provides sufficient heat to deactivate most pathogens, and produces a quality final product that would not require an incentive payment to facilitate movement of the litter off farms.

Action items and potential research needed to make in-house composting the preferred option for disposal in a disease outbreak and catastrophic loss:

1) Identify suitable compost sites on individual farms for final composting and curing;
2) Identify and research which types of farms (i.e., broiler breeder, turkey breeder, double-deck houses) may need to compost outside of the house after euthanasia and depopulation;
3) Evaluate biosecurity and farm-to-farm transmission concerns prior to bird and litter movement;
4) Identify and secure several sources of carbon material (e.g., sawdust and woodchips) before an outbreak occurs. Sources might include county landfills, lumber mills, electrical power companies, tree trimming companies, and compost from wastewater treatment facilities.
5) Negotiate a long term contract for at least enough carbon material to compost five average size farms in an outbreak (i.e., about 10 tractor trailer loads@100 cy./load).
6) Encourage integrators to identify a site to stockpile carbon materials such as a county landfill or one of their facilities.
7) Request each integrator to designate a team or person to be trained for managing in-house composting in an outbreak and catastrophic loss.

In-house composting is an acceptable cost-effective method of disposal and disease containment. In-house composting has not been considered a viable option by the industry and farmers because of the potential loss of production space and the perception that composting would not work on turkeys. In-house composting of turkeys demonstrates that with a good base, cap, and proper disease monitoring, the compost could be turned and moved out of the poultry house within 3 to 4 weeks. This time would be comparable to the minimum down time experienced by farmers in the 2002 avian influenza outbreak. Each farm and type of flock would have to be evaluated, but with proper planning and training of farmers and industry personnel, in-house composting is an effective rapid response tool for managing catastrophic poultry losses.

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